l of Mosquitos and the Recovery of Ecosystem Services in Urb

Jennifer Ramos, Ciara Walsh, Savanah Solomon, Kyla Charlebois, TA 1, TA 2, Instructor Name

University of Detroit Mercy

INTRODUCTION

- Ecosystem processes and functions that advance and promote human health are known as ecosystem services.
- Identifying ecosystem services is key to urban sustainable development, given the growing evidence that the public-benefits of maintaining green urban landscapes that recover ecosystem functions exceed the public-costs of maintaining a clinical approach that intervenes only at the individual-level post-contamination (Lovasi et al. 2008).
- Mollies are freshwater fish belonging to a taxonomic family (Poeciliidae) made up of many species with opportunistic diets (that include mosquitos) and are common in rivers and streams throughout El Salvador (Figure 1). However, the four major rivers in the capital province of San Salvador are severely polluted (Figure 2).
- The objective of our study was to evaluate the role of mollies as a biological control agent of mosquito populations during their (aquatic) larval stage.
- We hypothesized that the number of mosquito larvae would be lower in cups with mollies than in cups without mollies.

METHODS

- We collected 30 mollies (*Poeciliopsis gracilis*) from a tributary stream of the El Jute river in Zaragoza township, La Libertad province, El Salvador.
- The tributary stream is anthropogenically disturbed, runs along two residential areas (*Palo Alto* and *Las Brisas de las Mercedes*), and gray-water effluent inputs as well as garbage are easily observable (Figure 3).
- The molly species (Figure 4) was identified using field identification keys (Reis et al. 2003; McMahan et al. 2013).
- We used 250 ml plastic cups, which were mounted on trays in pairs; one control cup without a molly and a second treatment cup with a molly.
- 15 trays (n=30 cups total) were placed in field conditions in understory vegetation (Figure 5).
- Fish were not fed during the experiment, which ran for 30 days.

Figure 1. San Salvador, El Salvador.

Figure 2. Pollution of urban rivers in El

Figure 3. Field sampling along polluted waterways; note gray-water effluent inputs and plastic debris.

Figure 4. Native freshwater mollies (*P. gracillis*) sampled from urban rivers.

Figure 5. Mollies were present in treatment cups and absent in control cups.

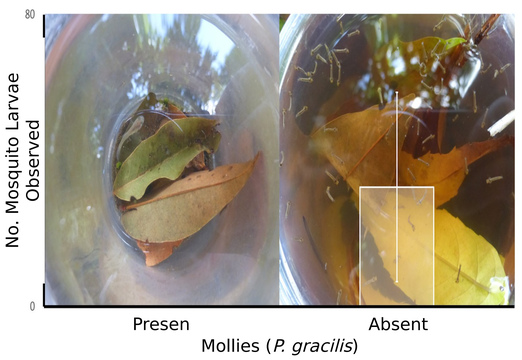

Figure 6. Changes in the number of mosquito larvae observed under two molly treatments.

Figure 7. Insecticide-fumigation is the principal form of Mosquito-control used in El Salvador.

Figure 8. Recovery of urban rivers and streams would sustain native mosquito-antagonist species.

RESULTS

- The number of mosquito larvae observed was significantly greater than expected in control cups (without mollies) and significantly lower than expected in treatment cups (with mollies) (χ^2=32.75, p<0.001, Figure 6).
- In control cups (without mollies) we observed an average of 33 ± 26 ($\bar{x}$ ± SD) mosquito larvae; representing 1 mosquito larva per 7.6 ml of standing water. The maximum number of observed larvae in control cups was 72 individuals; representing 1 mosquito larva per 3.5 ml of standing water.
- In treatment cups (with mollies) we did not observe any mosquito larvae.

DISCUSSION

- Following the introduction of mollies in cups containing mosquito larvae, we directly observed mollies consume mosquito larvae.
- The number of mosquito larvae was significantly lower in artificial habitats with mollies than in those without mollies (Figure 6).
- The mollies in our study demonstrated great plasticity in their ability to feed exclusively on mosquito larvae for an entire month.
- Similarly, the mosquito larvae in our study demonstrated great plasticity in their ability to grow in small volumes (3.5 ml – 7.6 ml) of standing water.
- Our direct observation of mollies feeding on mosquito larvae discounted the possibility that mosquitos do not lay eggs when mollies are present and/ or actively feeding on mosquito larvae.
- In El Salvador, mosquitos are vectors for many human diseases: Dengue, Chikungunya, Zika, Malaria, Filariasis, and Yellow Fever.
- As a mosquito-antagonist, Mollies may serve as an important tool to complement current mitigation campaigns (Figure 7).
- The sustainability of ecosystems services, such as the biocontrol of mosquitos by native mollies will depend directly on the recovery of polluted urban rivers in El Salvador (Figure 8).
- Because mollies are observed to grow in small quantities of water, garbage cleanups must

LITERATURE CITED

Reis RE, Kullander SO, Ferraris CJ. 2003. Check list of the freshwater fishes of South and Central America. Edipucrs (Eds), Porto Alegre, Brazil.

Lovasi GS, Quinn JW, Neckerman KM, Perzanowski MS, Rundle A. 2008. Children living in areas with more street trees have lower prevalence of asthma. Epidemiol Community Health 62(7):647-649.

McMahan CD, Matamoros WA, Alvarez Calderon FS, Yamileth Henriquez W, Recinos HM, Chakrabarty P, Barraza E, Herrera NJ. 2013. Checklist of the inland fishes of El Salvador. Zootaxa 3608(4):440-456.